

**CHARACTERIZATION OF BIODIESEL
PRODUCTION FROM *MORINGA OLEIFERA***

IQMAL HAKIM BIN MOHD KORDI

**BACHELOR OF CHEMICAL ENGINEERING (GAS TECHNOLOGY)
UNIVERSITI MALAYSIA PAHANG**

©IQMAL HAKIM (2014)

CHARACTERIZATION OF BIODIESEL PRODUCTION FROM *MORINGA OLEIFERA*

IQMAL HAKIM BIN MOHD KORDI

Thesis submitted in partial fulfilment of the requirements
for the award of the degree of
Bachelor of Chemical Engineering (GAS TECHNOLOGY)

**Faculty of Chemical & Natural Resources Engineering
UNIVERSITI MALAYSIA PAHANG**

SEPTEMBER 2014

©IQMAL HAKIM (2014)

SUPERVISOR'S DECLARATION

We hereby declare that we have checked this thesis and in our opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Bachelor of Chemical Engineering (Gas Technology).

Signature :
Name of main supervisor : DR. Eman N. Ali
Position : SENIOR LECTURER
Date :

STUDENT'S DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. The thesis has not been accepted for any degree and is not concurrently submitted for award of other degree.

Signature :
Name : IQMAL HAKIM BIN MOHD KORDI
ID Number : KC10048
Date :

Dedication

*I dedicate this thesis for my family for support me with affection and love
and their dedicated partnership for success in my life*

ACKNOWLEDGEMENT

I would like to thank my supervisor, Dr Eman N. Ali, for a really interesting research topic and also for all his assistance and support throughout the year.

I would also like to thank to everybody who helped me with obtaining the information I needed for my study, people that I would like to give special mention to all my friends, especially Hamdan and Zulfadzli, for the good times during the years.

Lastly I would like to my parents for all the support during all my years at University Malaysia Pahang and thank to Allah for all the abilities and opportunities He provided me with.

TABLE OF CONTENTS

SUPERVISOR’S DECLARATION	IV
STUDENT’S DECLARATION	V
<i>Dedication</i>	VI
ACKNOWLEDGEMENT	VII
TABLE OF CONTENTS.....	IX
LIST OF FIGURES	X
LIST OF TABLES	XI
LIST OF ABBREVIATIONS.....	XII
1 INTRODUCTION	1
1.1 Motivation and statement of problem	1
1.2 Objectives.....	2
1.3 Scope of this research.....	3
1.4 Main contribution of this work	3
2 LITERATURE REVIEW	4
2.1 Introduction	4
2.2 Moringa oleifera: Characteristics of the plant.....	4
2.3 Nutritive value of Moringa oil	5
2.4 Oil extraction.....	8
2.5 Transesterification process.....	8
3 MATERIALS AND METHODS.....	11
3.1 Introduction	11
3.2 Materials.....	11
3.3 Method	11
3.3.1 Oil extraction from Moringa oleifera seeds	11
3.3.2 <i>Transesterification reaction using KOH</i>	13
3.3.3 <i>Washing process</i>	15
3.3.5 <i>Gas Chromatography test</i>	16
3.3.6 <i>Characteristics and properties of biodiesel</i>	16
4 Result and Discussion	18
4.1 Introduction	18
4.2 Result.....	18
4.2.1 <i>Physical and chemical properties of MOMEs</i>	18
4.3 Discussion	19
4.3.1 Kinematic viscosity.....	19
4.3.2 Cloud point and pour point	19
4.3.3 Cetane number	20
4.3.4 Density	20
4.3.5 Acid value	21
5 Conclusion	22
5.1 Conclusion.....	22
5.2 Future work	23
REFERENCES	24

LIST OF FIGURES

Figure 1: <i>Moringa oleifera</i> tree	4
Figure 2: <i>Moringa oleifera</i> seeds	7
Figure 3: Transesterification process	9
Figure 4: Soxhlet extractor	12
Figure 5: Rotary evaporator	12
Figure 6: Extracted pure oil	13
Figure 7: Before washing process	15
Figure 8: After washing process	15

LIST OF TABLES

Table 1: Physical characterization of pods and seeds	6
Table 2: Comparison between alkali and acid catalysed transesterification	10
Table 3: Experimental design for the transesterification of <i>Moringa oleifera</i> oil	14
Table 4: Standard ASTM D6751 and EN 14214	16
Table 5: Properties of MOMEs with comparison to biodiesel standards.	18

LIST OF ABBREVIATIONS

ASTM	American Society for Testing and Material
EN	European standard
KOH	Potassium hydroxide
MOMEs	<i>Moringa oleifera</i> methyl esters
MOSO	<i>Moringa oleifera</i> seed oil
GC/MS	Gas Chromatography-mass spectrometry